

Improvements in or relating to the repair of insulated electric conductors

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Abstract

773,832. Moulding cable insulation. BRITISH INSULATED CALLENDER'S CABLES, Ltd. March 12, 1956 [March 11, 1955], No. 7269/55. Class 87(2). [Also in Group XXXVI] Conductor insulation 13 of homogeneous fused P.T.F.E. is repaired by removing the faulty insulation, replacing it by lapping on unsintered P.T.F.E. tape, enclosing the repair in a pressure-resistant mould and heating to sinter the tape. The ends of the sound insulation adjacent the repair are preferably tapered and roughened, and the ends of the tape to be applied are broken under tension when they will adhere to adjacent layers. The tape is applied under tension and then shaped in an aluminium mould 5, 6, which is closed by hand pressure to compress the tape. This is repeated several times with the cable differently oriented and any spill from the final pressing is pared off. The mould is placed in a heater comprising lower and upper plates 7, 9 and the heater closed. The repair is heated to 360 -380 C. for an hour by heating elements 10, 11, the heating being controlled by a thermocouple 12 within the mould. After heating the thermocouple is disconnected and the mould and its contents quenched in cold water. The mould is removed and the repair smoothed if necessary.

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Description

PATENT SPECIFICATION 773,8

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International Classification:-B 29 d, f H 02 g.

COMPLETE SPECIFICATION.

Improvements in or relating to the Repair of Insulated Electric Conductors.

We, BRITISH INSULATED CALLENDER'S CABLES LIMITED, a British Company, of Norfolk House, Norfolk Street, London, W.C 2, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

This invention relates to the repair of insulated electric conductors having a homogeneous fused dielectric of polytetrafluorethylene (hereinafter for brevity referred to as P T F E) Occasionally faults may occur in the dielectric Attempts to repair such faults by cutting out the faulty insulation and replacing it by similar insulation have not hitherto been successful owing to the lack of adhesion between the original and the replacement insulating material.

We have now found that a satisfactory repair can be made by removing the faulty P.T F E insulation from the conductor, replacing the insulation so removed by lapping unsintered P T F E tape around the conductor, enclosing the lapped unsintered tape insulation in a pressure resistant mould and sintering it by the application of heat On the completion of the sintering process the mould and its contents may be quenched in water after which the mould may be removed.

We have found that in the foregoing method of making a repair, which constitutes our invention, the continuous sleeve formed by the sintering together of the turns and layers of the applied tape unites with the ends of the homogenous fused P T F E.

dielectric under the combined influence of temperature and the pressure exerted by the thermal expansion of the P T F E tape.

The repair tape may be made from a L paste of P T F E in the form of a fine powder in a dispersal medium, such as cetane or white spirit containing polyisobutylene, by extruding it as a rod, sheeting out the rod on a calender and subsequently drying the sheet Drying the sheet will drive off substantially all of the polyisobutylene and solvent that may be included in the tape.

Any traces remaining will disappear below the sintering temperature of the P T F E.

In addition to removing the faulty P T F E.

insulation from the conductor it is preferable to taper the neighbouring ends of the sound P T F E dielectric Preferably the tapered ends are roughened by scraping and the unsintered P T F E tape is applied over the tapered ends After the repaired conductor has been removed from the mould it may be smoothed, if necessary, by means of glass paper or emery cloth or by the use of a paring knife.

The invention will now be described by way of example with reference to the accompanying drawing wherein:Figure 1 shows, in section, a length of P.T F E cable with the insulation cut away along a portion of its length; Figure 2 shows the cable of Figure 1 reinsulated by a lapped body built up of unsintered P T F E

tape; and Figure 3 shows a heater and two-part mould for sintering the lapped body of unsintered P T F E tape.

The length of cable of Figure 1 comprises a conductor 1 insulated with an extruded layer of P T F E insulation 2 A sharp knife is used to cut away the insulation to form a pencil or scarf 3 on both sides of a fault The pencil is approximately four diameters long with a circular section along its complete length and the surface is 7 " So Sly 773 832 roughened by rubbing the knife edge along its surface, care being taken to ensure that the exposed conductor remains undamaged and that no dirt or grease is allowed to contaminate the area.

The cable is reinsulated by a lapped body 4 built up of unsintered P T F E tape applied under such tension that the tape does not yield unduly For a cable of diameter 1 0 0 091 " a tape of about " wide is suitable and for a cable of diameter 0 267 " a tape up to about 4 " wide may be used, the tape in each case being nominally 0 005 " thick.

To begin the winding operation the tape is broken under tension to give to the starting end of the tape a very thin fibrous texture This end is immediately applied to the centre of the exposed length of conductor, and wrapped round it, this freshly produced thin portion being such that it is capable of adhering to itself sufficiently to enable winding to continue under tension, so avoiding any looseness or lumpiness in the centre of the repair The winding is carried out as evenly as possible to build up the centre of the repair to a diameter greater by about 10-15 % than that of the original cable Preferably the excess diameter decreases evenly towards the edges of the repair so that at the sound insulation some two tape widths beyond the edge of the original pencil it is only the thickness of one tape, and this portion of tape is broken under tension and smoothed firmly with the fingers over the wrapped area to which it adheres.

The taped cable 13 is placed in a mould, shown partly broken away in Figure 3, comprising two metal blocks 5, 6 having mating semi-circular grooves in their opposing surfaces Aluminium is a suitable material for the mould because it is corrosion-resistant at the sintering temperature in the presence of P T F E and its decomposition products.

The mould is fitted around the repair and is closed by hand pressure to compress the tape This operation is repeated several times with the cable differently oriented with respect to the mould Any spill from the final pressing is smoothed down with a knife so that the repair fits the mould without any flash being formed.

The two mould halves are then placed in a heater, as shown in Figure 3, comprising a a lower plate 7 and a member 8 on which is pivotally mounted an upper plate 9, the member 8 being pivotally mounted on the lower plate The repair portion being inserted centrally within the mould halves 5, 6, the heater is closed and held in that position by a weight or otherwise The repair is heated to a temperature of 360-380 ' C for an hour by heating elements 10 and 11, situated in the lower and upper plates of the heater respectively, the heating being controlled by a thermocouple 12 within the mould.

After sintering has been completed the thermocouple is disconnected and the mould and its contents are removed from the heater 70 and preferably quenched in cold water The quenching of the P T F E imparts to it a high flexibility and high tensile strength.

The mould is then removed and the repaired conductor is smoothed, if necessary, by 75 means of glass paper or emery cloth or by the use of a paring knife.

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Claims

What we claim is:-

1 A method of repairing an insulated electric conductor having a homogeneous fused dielectric of P T F E, comprising removing the faulty P T F E insulation from the conductor replacing the insulation so removed by lapping unsintered P T F E tape around the conductor, enclosing the lapped unsintered tape insulation in a pressure resistant mould and sintering it by the application of heat.

2 A method of repairing an insulated electric conductor having a homogeneous fused dielectric of P T F E, comprising removing the faulty P T F E insulation from the conductor and tapering the neighbouring ends of the sound P T F E dielectric, lapping unsintered P T F E tape around the conductor and over the roughened tapered ends of the original dielectric enclosing the lapped unsintered tape insulation in a pressure resistant mould and sintering it by the application of heat 100 3 A method of making a repair to an insulated electric conductor having a homogeneous fused dielectric of P T F E, comprising removing the faulty P T F E insulation from the conductor and tapering the neighbouring ends of the sound P T F E.

dielectric removing an end portion of a length of unsintered P T F E tape by breaking the tape under tension to form a starting end thereon of very thin fibrous texture, 110 applying the starting end to the conductor and lapping the tape under slight tension around the conductor and over the tapered ends of the original dielectric to build up the centre of the repair to a diameter slightly 115 greater than that of the original cable, and thereupon breaking the tape under tension, smoothing the free end of the lapped portion firmly with the fingers over the underlying insulation, enclosing the lapped unsintered 120 tape insulation in a pressure resistant mould and sintering it by the application of heat.

4 A method of repairing an insulated electric conductor having a homogeneous fused dielectric of P T F E, comprising re 125 moving the faulty P T F E insulation from the conductor and tapering the neighbouring ends of the sound P T F E dielectric, roughening the tapered ends of the sound P.T F E insulation, lapping, under slight 130 tension, unsintered P T F E tape around the conductor and over the roughened tapered ends of the original conductor dielectric, enclosing the lapped unsintered tape insulation in a pressure resistant aluminium Agent for the Applicants, mould, sintering it by the application of heat, upon completion of the sintering process quenching the mould and, if necessary, conductor and over the roughened tapered smoothing the repaired conductor.

ends of the original conductor dielectric, enclosing the lapped unsintered tape insulation in a pressure resistant aluminium Agent for the Applicants, mould, sintering it by the application of heat, upon completion of the sintering process quenching the mould and, if necessary, conductor and over the roughened tapered smoothing the repaired conductor.

PROVISIONAL SPECIFICATION.

Improvements in or relating to the Repair of Insulated Electric Conductors.

We, BRITISH INSULATED CABLES LIMITED, a British Company, of Norfolk House, Norfolk Street, London, W.C 2, do hereby declare this invention to be described in the following statement: This invention relates to the repair of insulated electric conductors having an extruded dielectric of polytetrafluorethylene (hereinafter for brevity referred to as P.T F E) In the manufacture of such insulated conductors the conductor leaves the extruder with its dielectric in a sintered condition Occasionally faults may occur in the dielectric Attempts to repair such faults by cutting out the faulty insulation and replacing it by fresh P T F E insulation have not hitherto been successful owing to the lack of adhesion between the original and the replacement insulating material.

We have now found that a satisfactory repair can be made by removing the faulty P.T F E insulation from the conductor and tapering the neighbouring ends of the sound P.T F E insulation and lapping unsintered P.T F E tape on the bared conductor and over the tapered ends of the original conductor dielectric, enclosing the lapped unsintered tape insulation in a pressure resistant mould and sintering it by the application of heat On the completion of the sintering process the mould and its contents may be quenched in water after which the mould may be removed and the repaired conductor be smoothed, if necessary, by means of glass paper or emery cloth.

We have found that in this way the continuous sleeve formed by the sintering together of the turns and layers of the applied tape unites with the tapered ends of the extruded sintered P T F E dielectric under the combined influence of temperature and the pressure exerted by the thermal expansion of the P T F E tape.

The repair tape may be made from a paste of P T F E in the form of a fine powder in a dispersal medium,

such as acetone, by extruding it as a rod and sheeting out the rod on a calender.

The mould may be a two-part casting, for instance of aluminium or it may be formed in situ on the taped conductor by enclosing the taped insulating by a lapping or wrapping of metal tape.

A satisfactory temperature to which to heat the mould is between 400 C -450 C.

The duration of the heating period will depend on the internal and external diameters of the dielectric wall For a conductor having a diameter of 0.05 inch and a dielectric wall thickness of 0.025 inch, it is satisfactory to heat the mould from ambient temperature to 450 C in from 5 to 15 minutes and to maintain it at 450 C for from 5 to 10 minutes before quenching in water For a conductor having a diameter of 0.13 inch and a dielectric wall thickness of 0.045 inch, it is satisfactory to heat the mould-from ambient temperature to 450 C.

in from 15 to 30 minutes and to maintain it at 450 C for from 30 to 60 minutes before quenching in water.

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FIG. 1.

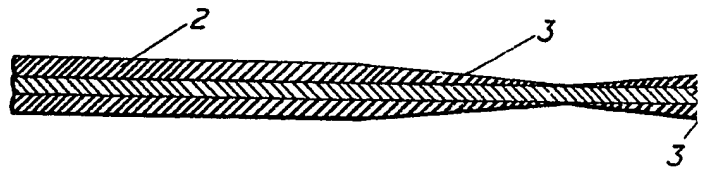


FIG. 2.



FIG. 3.

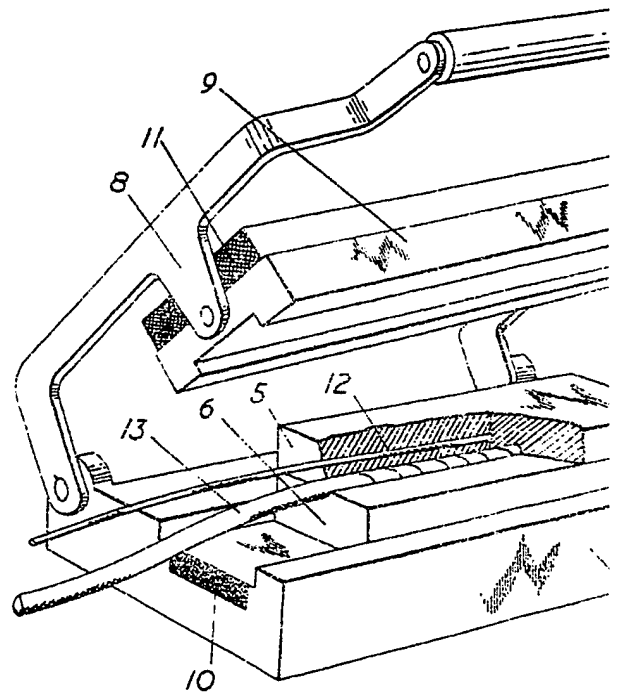
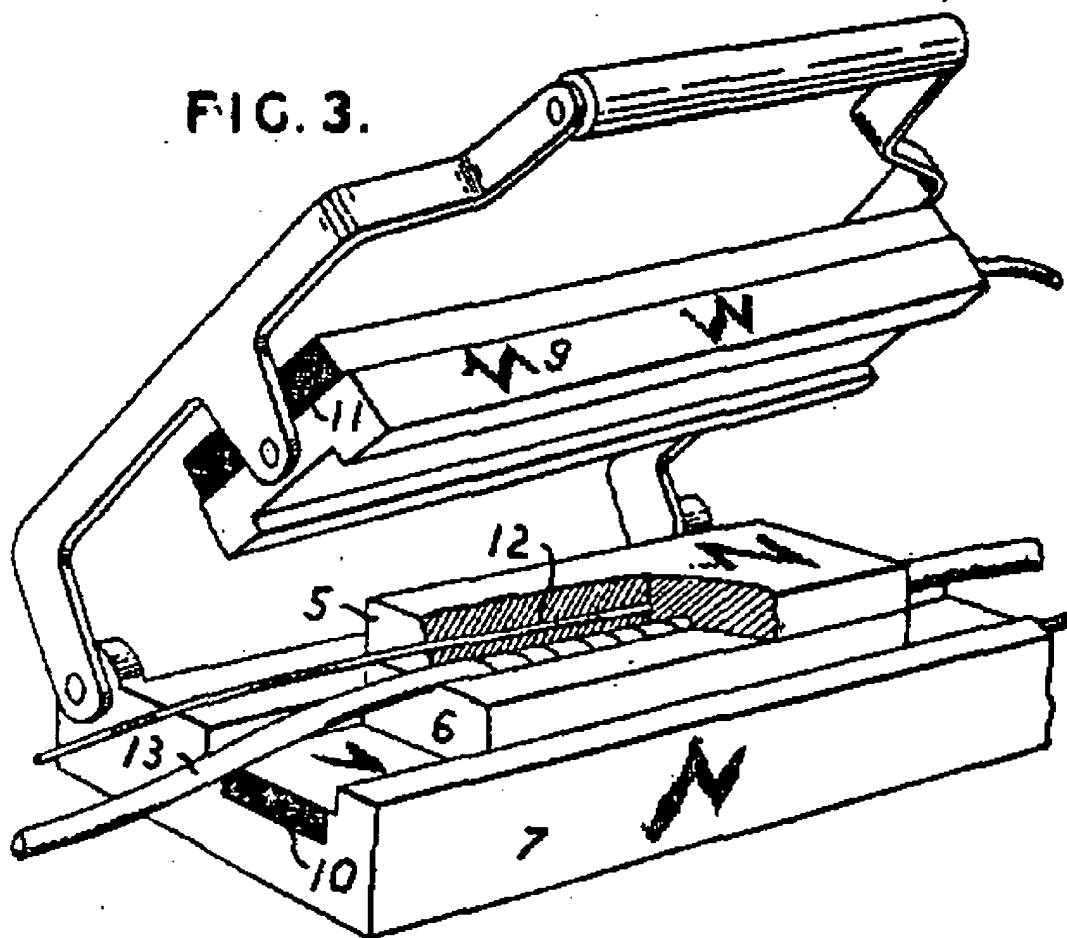


FIG. 3.



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